WFIRST-SDT Final Report

Exoplanet Coronagraphy

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1. Introduction — Kasdin, Guyon

Background on coronagraph and exoplanet science, motivate objective of showing that for minimum high-contrast case there is still excellent science and for stretch performance there is additional science, perhaps touching on SuperEarths. Also explain three main science cases: Transitional & Debris Disks, Exozodi, Giant Planets.

2. Performance assumptions — Kasdin, Guyon

baseline: 3 lam/D coronagraph, 1e-8 raw, 1e-9 calibrated

aggressive: reducing iwa down to 2 and 1 lambda/D, more aggressive calibration assumptions (factors of 100 to 1000).

3. Debris Disk Science — Greene

4. Exozodi measurements and effect — Traub

5. Polarization science — Breckenridge

6. Planets — Kasdin, Greene, Traub

Radial Velocity Planet Characterization
Giant Planet discovery and Spectroscopy
Design Reference Mission Assumptions and Predictions

7. Aggressive Science/Rocky Earths & Super-Earths — Guyon

AFTA WFIRST Coronagraph (WFIRST-C) Instrument Description

A Joint Report of the AFTA WFIRST Coronagraph Science Definition Team and Mission Concept Study Team

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CHANGE LOG

Version	Date	Author	Revision
0.0	11/22/05	Kasdin, Levine	First version presented at SDT #2

COMMENTS

Because of the page constraints Science: 5 pages & Design: 3 pages - details of the AFTA WFIRST Coronagraph (WFIRST-C) will be provided in appendices

The WFIRST-C study team will meet regularly (bi-weekly?) through April to monitor progress

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The schedule is TBD

1/10/12	**Section leads to provide rough draft**
Xx/xx/xx	**Fill-in report milestones**
4/01/12	**Final draft of WFIRST-C report delivered to AFTA SDT**

Writing responsibilities are defined with the following colors:
blue (SDT leads), red (Design team leads), green (together)

The goal is to describe the science objectives and requirements, the design reference mission, and the WFIRST-C baseline design concept that demonstrates feasibility of the mission. The baseline design will identify appealing science achievable with existing technology. Science achievable with a more aggressive coronagraph will be presented as stretch goals.
It is noted that WFIRST-C is “a” concept which achieves the science goals, and it is not intended to be the final design. Further studies and technology demonstrations will be required to optimize the performance and coronagraph designs. Alternative options will be described herein for reference.
The baseline concept also assumes that an order of magnitude improvement in contrast is achieved through data post-processing. Section 4 will identify techniques for improving contras through data processing.

The document must have a logical flow and should follow the familiar pattern of science requirements -> technical requirements -> technical description -> technology development plan.

OUTLINE

1. WFIRST-C Baseline Mission Concept Description & Rationale

3.1. Introduction

Set the stage for decisions – what is important, evolution of the design & summary system description. Describe in broad terms telescope, sss, instrument … Follow the photons. (Speckle removal technique: possible dithering, or DM options, …), Observing scenario, timeline, orbit …

Mission Description Table

Describe each WFIRST-C element as an existence proof: a demonstration of feasibility with the understanding that not all options have been investigated to date and trades are still work in progress.

All alternative options and trades summarized later in section 4.

FB1 validation for Dynamic EB only.

3.2. Science Derived Requirements (Shaklan Horner)

science reqts, mission reqts: sensitivity, throughput, resolution, observing overhead, orbit, observing scenario

3.3. System Architecture

- 3.3.0.1. Optical Configuration
- 3.3.0.2. Mechanical Configuration
- 3.3.0.3. Mechanisms
- 3.3.0.4. Thermal Control
- 3.3.0.5. Data Systems
- 3.3.0.6. Mass
- 3.3.0.7. Power
- 3.3.0.8. Trades
- 3.3.1. Science Instrument Payload
  - 3.3.1.1. Starlight Suppression System
  - 3.3.1.2. Wave Front Sensing and Control
  - 3.3.1.3. Low Order Wave Front Sensor and Control
  - 3.3.1.4. Spectrometer

3.4. Mission Operations

- 3.4.2. Mission Description
- 3.4.3. Observatory Field of Regard
- 3.4.4. Observational Strategy of Each Target Star
- 3.4.5. Orbit Environmental Issues